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Mecheleciv



VOL. 16

OCTOBER 1956

NO. 1



**SCHOOL OF ENGINEERING
THE GEORGE WASHINGTON UNIVERSITY**

OCTOBER 1956

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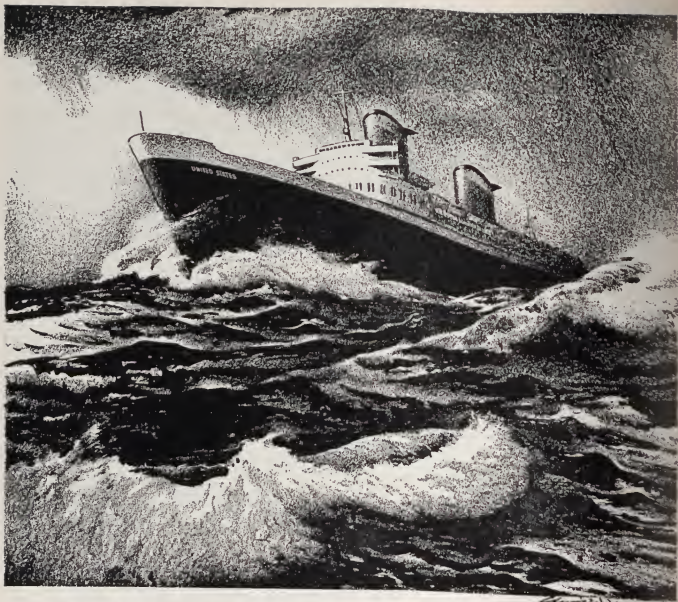
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SCHOOL OF ENGINEERING, THE GEORGE WASHINGTON UNIVERSITY

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ON OUR COVER

A non-engineer's conception of the typical engineering student at work.
Artwork is by Harold Gullen who was Art Editor of MECHELECIV in 1954.

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Inco Nickel Progress Report

*How Inco's more-from-the-ore
research program is expanding
North America's natural resources*



Once the iron in Nickel-containing pyrrhotite went to slag heaps.



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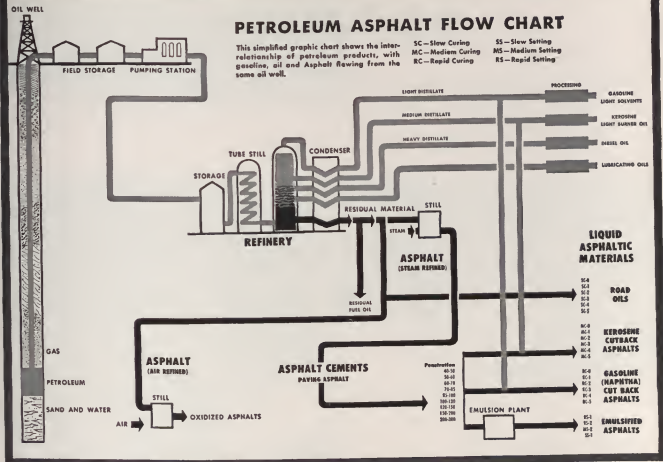
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Inco's new full-color, sound film! 16mm prints loaned to engineering classes and student technical societies. The International Nickel Co., Inc., Dept. 127e, New York 5, N. Y.
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struction and specialty applications also call for ever-increasing quantities of emulsified Asphalts... minute globules of Asphalt suspended in chemically treated water.

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THE ASPHALT INSTITUTE, Asphalt Institute Building, College Park, Maryland

AUTHORS

John Manning has become one of the most prolific contributors to *Mecheleciv* with the publishing of "The Magnetron Beam Switching Tube" last May, "—The Fuel of Interest to the Fire of Genius" in this issue, and another article on electronic storage devices scheduled for a future issue. John started out to be a C.E. at GW in 1942 but had only completed the first semester when he left for a five-year tour in the Merchant Marine where he was a Chief Steward, followed by two years in the Army as a Mess Sergeant. Apparently mixing of the ingredients for chow got into his blood because on his return he changed his major to B.S.E. with Chemistry Option.

The subject of his article in this issue, Patents, is thoroughly familiar to him since he works as a patent-searcher for Burroughs Corporation.

John is Chairman of AIEE-IRE and is also active in Theta Tau and the Newman Club. The reason for his extra-broad grin in recent days is that his wife, Helen, presented him with a son, Paul Raymond, on September 11.

Sy Mathews acquired his drawl in his native state, North Carolina, and brought it with him when he came to this area in 1943. After graduating from Wilson High School he attended Oberlin College for one year working toward a degree in chemistry but got interested in TV and decided to switch to engineering. When he gets his B.S.E. with Math Option next Spring he would like to go to graduate school at Tennessee or N. C. State.

Sy works at being a TV repairman on a part-time basis and, on campus, is in Theta Tau, Sigma Tau, and AIEE-IRE. His favorite hobby is Duplicate Bridge and he is a member of a Tuesday morning bridge club which consists of 16 members, 15 of whom are women.



Mohammed Bashir Ludin was born near Kabul, which is the capital of Afghanistan, and is only a few miles from the famous Khyber Pass. He is attending GW on a grant from the Royal Government of Afghanistan. After he receives his B.C.E. degree in February 1957 he expects to go to graduate school at Stanford or Princeton but eventually will return to Afghanistan to work on reclamation and irrigation projects.

Although English is not Bashir's native language, he handles it as if it were. One of the reasons for this is that he studied English as early as the fifth grade and was taught by American High School teachers who spoke English exclusively.

Bashir's hobby is writing. He has written several articles for Kabul Magazine in his native country and is at present writing a book in Pashtu, one of the official languages of Afghanistan, on Islamic scientists who lived between the 7th and 14th centuries. *Mecheleciv* will publish some material (in English) from his book in the November or December issue.

Dave Lewis developed his interest in hardness testing through doing such tests as part of his duties in the Materials Lab at the Naval Gun Factory where he has worked for the last two summers.

Dave is active in Theta Tau and ASME and hopes to graduate next June. His plans for what will happen after that are indefinite other than finding a job by running the gamut of interviewers and, sooner or later, contributing his stint to Uncle Sam.

Whenever time permits, Dave relaxes with the hobbies of hunting, fishing, metalwork, and tinkering with automobiles.

After impressing the editors by turning in his article for this issue on the Monday after the Friday on which he was given the assignment, Dave practically dumbfounded them by also turning out the illustrations with equal dispatch and with a display of talent rare among the engineers.





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MARTIN

FACULTY PAGE

ENGINEERING SCIENCE

THE ROLE OF SCIENTIFIC EDUCATION IN ENGINEERING

By EARNEST FRANK

Executive Officer of the Electrical Engineering Dept.



Now that the smoke of registration has cleared and the construction noise in our new Tompkins Hall has subsided, we can all settle down to some serious work. I would appreciate it very much if, in the course of your busy schedule, you could find time for a visit with me in Room 313. Although I have met some of you (perhaps under harrowing circumstances) I would like to become thoroughly acquainted with your attitudes and goals and what you expect from your engineering education. I am here to help develop and build a really outstanding engineering school and to aid you as an individual student in your professional pursuits. Obviously this must be done in realistic terms, and I must learn why things have been done as they have been in the past and what your thoughts are concerning the variety of complex items which constitute your college environment.

Naturally I have already formed certain impressions of the school and, of course, have come here with many specific convictions. Among these I feel the most pertinent to discuss now and perhaps the one of broadest implication to the undergraduate program has to do with the kind of education most suitable to equip you for a successful career in engineering. You have doubtless been affected by the new curriculum and may wonder what it means. Continuous evolution and change should not be surprising in view of the fast-moving and dynamic role engineers play in today's technological age. Clearly our educational methods and objectives cannot fall behind the pressing needs.

The head of a large industrial research organization recently made the following comment to me: "We do not want you to teach students the details of various color television systems because we in our laboratories are five years ahead of anything your faculty knows. Anything specific you teach represents an impediment rather than useful knowledge." Evidently, the kind of education that is best for you is the kind that does not become obsolete. And that means learning how to think rigorously, how to use the many powerful analytical tools that have been found useful in engineering, and how to solve new problems. You may never learn in school how yesterday's or today's television circuits work, but you should acquire a foundation in the prin-

ciples upon which such circuits are based and, most important, a confidence that you are able to attack effectively any new problem. Indeed, it is only with this kind of equipment that you can compete for the challenging job of formulating tomorrow's engineering advances.

This scientific type of engineering education represents a strong challenge to the faculty as well as to the student. It means a penetrating theoretical approach, emphasis on mathematical analysis, and less regard for current practice. It means you should acquire a solid analytical background (not merely an ability to follow a mathematical development), you should become skilled in solving new problems (not just duplicates of the kind that have been assigned), and you should become facile in cutting across fields to glean necessary information (not giving up when carried outside your field of specialization). Today there is a strong need for this kind of engineering education which in many ways is closer to applied mathematics or mathematical physics than to the type of engineering training considered adequate as recently as a decade ago. It is the kind of education which I feel is most appropriate to develop at The George Washington University, not only because Washington is a research and development center, but also because it is the best kind of preparation for graduate study which is becoming increasingly requisite for the really interesting jobs in engineering. The new curriculum represents a step in this direction, although it takes much more than a list of courses to achieve the desired result.

The engineering-science type of education very briefly and incompletely sketched here represents an exciting objective for all concerned, and it is being pursued by most of the leading schools. But it means strenuous brain work. Few things worth while come easily and that is true of this particular undertaking, but it can result in a firm foundation and a discipline of thought that will be with you for life and will favorably affect your entire career. Do you feel up to this challenge? I hope you do, and with enthusiasm. I look forward to the time when we can intensify our efforts in this direction. Best of luck in your studies and I hope we can all work together effectively toward a difficult but worth while goal.

EDITORIAL

Readers who have been awaiting a big spread on the new home of the School of Engineering, Tompkins Hall, will have to be patient for one more month. We had intended to devote practically the entire October issue to the new building but, as the students who are attending classes in the building realize, the finishing touches were not completed by the beginning of the school year. Since the magazine is planned and put together well in advance of publication, it was seen that we wouldn't be able to get pictures in time for this issue and the Tompkins Hall issue was postponed one month. The November issue will give the complete story from the turning of the first shovelful of earth, to the installation of the latest piece of new equipment. I can assure you that the building is a beautiful thing and we will try to do it justice in our next issue.

I would like to call to your attention the fact that in this issue we have published one general interest article and one dealing with each of the engineering fields represented at GW. With the cooperation of the C.E.'s, E.E.'s, and M.E.'s, we intend to follow this scheme throughout the school year.

Also in the next issue, we'll have the full quota of departments back including The Mech Miss which caused so much comment last year and, possibly, a problem page with problems of interest to scientifically inclined individuals.

A new, or rather a revived, department, will be a "Letters to the Editor" column or page. If any of you has a pet peeve you would like to air or anything else you think might be appropriate to a department of this sort, we would appreciate hearing from you. Simply address your letter to: Editor, "Mecheleciv Magazine," The George Washington University, Washington 6, D. C.

R. J. S.

A MESSAGE FROM THE COUNCIL

By HOWARD DAVIS B.M.E. '57
Engineers' Council President

Howard Davis came to GW in 1953 after 16 years in the U. S. Army where he was a Construction Officer. When he started through the School of Engineering, he planned to avoid extracurricular activities and concentrate on his studies. Three years later he found himself active in Theta Tau, ASME, and holder of the highest position in the School of Engineering, Engineers' Council President.



I would like to take the opportunity in our first issue of *Mecheleiv* to welcome back the returning students, welcome the new registrants, and extend cordial greetings to our Alumni.

This is a memorable year in the history of the School of Engineering. The thoughtful consideration and generosity of Mr. Charles H. Tompkins has made it possible for us to have our own Engineering Building, and it is with mixed feelings of pleasure and pride that we commence classes this Fall in Tompkins Hall.

During the past year the engineering curricula were revised with a view to meeting the changing needs of today's Engineer. With improved facilities and up-to-date curricula, it is for us, the students, to join in these progressive endeavors to improve the standards of our school. This we can do by taking a more industrious approach to our studies with a view to raising our academic standing, and finding ways to improve upon the practicality and utilization of our student organizations.

To promote the theme of improvement, the Engineers' Council is sponsoring several measures that it believes will aid student endeavor. Worthy of mention are weekly movies and lectures, a "Dean's List," a "Student Code of Ethics," and traditions of the Engineering School.

Student organizations, acting in turn, will conduct movies and lectures on selected engineering topics in the audio-visual room of Tompkins Hall on Tuesday noon of each week. It is felt that these programs will be beneficial in aiding us to gain technical background and improve our ability to comprehend the theories we study in the class room.

To publicly recognize those men who succeed in producing better than average work, and to provide an

incentive for which we can all strive, steps have been initiated to establish a "Dean's List." Under this proposal the Dean of Engineering would publish at the end of each semester, a list of those students who maintained a grade of "B" or better in all subjects. This proposal has the informal approval of the Dean, but at this writing, has not been approved by the University.

A special committee of Council members is drafting a "Student Code of Ethics." When approved by the Council, the proposed code will be distributed to student organizations for comments and recommendations. It is also proposed that one of our weekly lectures be devoted to an open discussion on the subject of the code. From these discussions it is hoped that we can adopt a code of ethics to which all students will voluntarily subscribe. I would like to point out that the code is not being proposed to impose a set of "herd-binding" rules on anyone, but rather that it should be considered a written plan to promote the development of individual excellence. It has long been characteristic of the professions to expect from their members a high standard of moral integrity and ethical conduct. It is therefore believed to be in our interests to take a practical approach to the study of ethics at this point in our training for the engineering profession.

The Council is hopeful of establishing and promoting worthy traditions of the Engineer School. At present this matter is only in the talking stage and suggestions will be welcomed. Some of the ideas being bandied about are an "Engineers' Day," and a tradition built around the "Vault of the Future" that appears at the entrance to Tompkins Hall.

(Please turn to page 36.)

"...the Fuel of Interest to the Fire of Genius"

AND OTHERS

By JOHN MANNING B.S.E. '57

"The Congress shall have power . . . To promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries." So states Article 1, Section 8, the Constitution of the United States.

We see that our founding fathers realized the importance of the "exclusive right" of inventors to their discoveries and this exclusive right is expressed in a contract called a patent. The Encyclopedia Britannica defines a patent or letters patent thus: "Letters Patent (litterae patentes) are letters addressed by the sovereign 'to all to whom these presents shall come,' reciting the grant of some dignity, office, monopoly, franchise, or other privilege to the patentee. They are not sealed up, but are left open (hence the term 'patent') and are recorded in the patent rolls in the Record Office."

EARLY HISTORY

The growth of trade during the Middle Ages and up to the start of the 17th Century was widely encouraged on the continent of Europe and in England by the grant of monopolies to various individuals or groups. This we will remember as the Mercantilistic Movement. The Hanseatic League, the most powerful early commercial institution, was made possible by the grant of exclusive trading rights of certain commodities throughout Northern Europe and in London.

By the time of Elizabeth I in England (1558 to 1603), the grant of monopolies by means of Letters Patent had become extremely widespread, and was used by Elizabeth to reward her favorite subjects. Lord Essex was given the exclusive right to import and sell certain French wines and this was Essex's source of income which enabled him to maintain Essex House in London and to raise his own army — the same army which eventually caused him to lose his head.

Here is a list of commodities which were signed over to patentees during the latter part of Elizabethan reign:

Currents, salt, iron, powder, playing cards, calfskins, vinegar, steel, brushes, pots, bottles, salt-petre, lead, oil, glasses, paper, starch, tin, sulphur, transportation of beer, of leather, importation of Spanish wool and Irish yarn. These are but a few of the commodities which had been appropriated to monopolists.

When James I came to the throne he revoked all of the exclusive privileges relating to domestic English commerce, but he retained the monopolies with respect

to importation from abroad. In 20 years, abuses had again reached such a point that Parliament passed the Statute of Monopolies of 1623. This act is to modern patent systems all over the world what the Magna Carta is to the rights of individuals. It limited the grant of letters-patent to 14 years and under for the working or making of new manufactures. It introduced the idea of giving the letters-patent only to the true and first inventor. In effect it set forth the principle that not all important discoveries can be patented.

Our own patent law starts before the Revolutionary War when patent rights were conferred by state legislatures. The first state to grant patents under its state law was Massachusetts in 1641. Today, as we know, patents are granted by the Federal Government.

NEED OF PATENTS

It is easy to see, and after a short explanation, it will not be difficult to understand, the need for patents.

In early times, at the dawn of man's development he began to make and use tools. They were his possessions. If man fashioned a hammer, it was his only as long as he retained possession of it. If he left the hammer unguarded, he might lose possession. If it were stolen, he could obtain another hammer either by regaining the lost one by force or by making a new hammer.

In all forms of primitive society, physical control was the only way of owning property. Under this system, the strong could take from the weak. One's conscience recognized this as wrong and steps were taken to prevent such "unlawful" taking; therefore, the ingenious theory of "title" was created.



DON'T EXPECT YOUR MONOPOLY TO LAST FOREVER

Artwork Courtesy of CGS Laboratories, Inc.

THE MECHELECTIC

Now, "title" may be loosely defined as the relation of a man to a thing by virtue of which he cannot be deprived of the thing except by his voluntary act or by operation of law. Therefore, it can be assumed if a man has the title to a thing, he came by it lawfully.

As we see it, when the hammer was first invented there was no law to prevent another from making a Chinese (exact) copy of it. In the early days with poor transportation and far reaching frontiers, there was no desire to restrain the second man from making or selling the hammer. Later, however, when industry became more organized and businessmen were depending upon the manufacture of hammers as a means of livelihood, it was felt that some protection was needed to manufacture any improvements thereof. But how could he keep the improvement if he sold a hammer containing the improvement? The person buying the improved hammer was free to copy the hammer and go into business for himself. If this occurred the inventor of the improved hammer could derive no advantage from his thought, time, effort, and money.

Later it became recognized that a man should have a right to his invention just as he has to his home or anything else he had worked for and received by his own efforts.

BASIC PROPOSITIONS

The patent law today rests on the following basic propositions:

1. The original and first inventor is given an exclusive right to make, use, and sell his invention for a period of 17 years; therefore don't expect your monopoly to last forever. This is expressed as a right to exclude others from making, using, or selling the invention.

2. The patent is granted by the government in return for a complete disclosure of the invention, so, that at the end of the 17 years, anyone can make and use the invention. The complete disclosure is extremely important since many patents are invalid because of insufficient disclosure. The patent application, and consequently the subsequent patent, if a patent is issued, must be written in such full, clear, concise, and exact terms as to enable any person skilled in the art or science to which it appertains, to make, construct, or compound and use the same.

3. The patent does not take away anything that the public had before. Patents are granted for inventions not known or used before. To encourage the development of the useful arts, it allows the inventor to keep others from practicing his invention for a limited time. In the long run the wealth of scientific knowledge will grow, since the invention protected is specifically explained in the printed patent on the day it becomes a patent.

MECHANICS OF A PATENT

Broadly, three parts of a patent can be detected; the drawings, specifications, and claims. More specifically, the divisions can be: (a) drawings, (b) statement of invention, (c) objects of the invention, (d) description of the drawings, (e) the disclosure, and (f) the claims. Following is a detailed discussion of each division.

(a) Drawings—The language of the drawings is the inventor's most convenient means of expression for it is the most readily and quickly understood. The

drawings need not be to scale but a clear drawing, skillfully prepared so as to bring home the points which the inventor wishes to make, is a decided asset to a patent, since it affords a view of the invention which would be difficult, if not impossible, to depict by words alone.

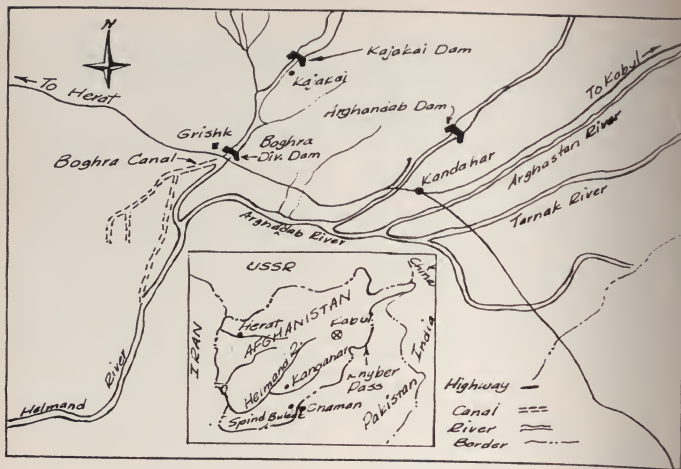
(b) Statement of Invention—The principal purpose of the statement of the invention is to give an understanding of the utility of the invention and of its advantages which the inventor believes are his contribution to the advance of the art. It may properly bring in a general picture of the state of the particular art at the time the inventor entered the field. It may set forth the disadvantages of the prior art and the obstacles confronting the inventor at the time. It may then set forth the manner in which the invention has surmounted the obstacle, or solved the problem, by description of one or more particular embodiments of the invention. There is one *caveat* (caution) to observe however, that is, one must not look to the statement of invention for a brief explanation of exactly what the invention covers. Many statements of invention are in general terms and during the prosecution of the application before the Patent Office, prior references may be cited to show that the inventor was mistaken in what he thought he had invented; and when he finally gets his application allowed on what patentable surplus it may contain, he neglects or forgets to amend his statement of invention in conformity with the actual state of the prior art.

(Please turn to page 34)



NOT ALL IMPORTANT DISCOVERIES
- CAN BE PATENTED

Artwork Courtesy of CGS Laboratories, Inc.



The TVA of AFGHANISTAN

By MOHAMMED BASHIR LUDIN CE '57

In Afghanistan, where ninety percent of the people depend on agricultural and pastoral activities for their livelihood and where rainfall is usually insufficient for normal crops and vegetation, irrigational projects are of great importance in raising the standard of living of the people. It was with the realization of this fact that the Royal Government of Afghanistan undertook the irrigational projects in the Helmand and Arghandab Valleys.

THE HELMAND VALLEY

The 625-mile long Helmand River, the largest and most important river which flows inside Afghanistan, has a large valley with great potentialities. A land survey performed by Morrison-Knudsen Afghanistan, Inc. shows that there are at least 550,000 acres of arable land in the valley, less than 40 percent of which was under cultivation before recent irrigational projects were undertaken. The soils of the valley are generally deep, silty, and fertile. The summers are hot and winters quite mild although freezing temperatures occur in mid-winter.

The history of the Helmand Valley goes back to pre-historic and *Avistan* times (about 300 years ago). In those days the Helmand Valley was prosperous and beautifully terraced. Until around 900 A.D., according to historians, controlled and regulated water was plentiful in cities and towns of the Helmand Valley and a stream flowed through practically every house. Medieval geographers called the Helmand Valley "The Garden of Asia," perhaps because of its beauty and possibly because the whole of Asia shared its fruits.

What had made this valley prosperous was the fact that the Helmand waters were harnessed by a system of diversion dams and canals. The names of some of the dams such as Kandak Dam, Rig Dam, and the Mofsidan Dam have been recorded in history. Most of these dams were probably of masonry construction.

After the Mongol raids (specifically those of Timur-lane) these diversion dams were destroyed. Consequently, the "Garden of Asia" faced an autumn centuries long, and during all this time it was nothing but

another burning spot in the heart of Asia. For many centuries the vast area of the Helmand remained a desert with some minor cultivated acreage here and there along the river banks. Finally in 1946, the Royal Government of Afghanistan decided to develop the fertile land of this area and to harness once again the waters of the Helmand. In the near future, the Helmand Valley will again become the "Garden of Asia."

After land survey and river flow measurements were performed by Morrison-Knudsen Afghanistan, Inc., the Royal Government of Afghanistan considered and applied the following general pattern in the development of the valley:

- (1) Regulation of the river by providing storage capacity to hold water wasted in floods.
- (2) Construction of diversion dams strategically located to turn controlled released water from storage into various canals.
- (3) Levelling of arable land suitably located.
- (4) Construction of canal systems.
- (5) Construction of roads, grain elevators, refrigerated warehouses, etc., so that increased agricultural production could be used efficiently.
- (6) Establishing of industries to utilize hydro-electric power developed as a by-product.

Step (1), which is of permanent importance, has been completed. Steps (2), (3), and (4) have been advanced to a great extent. Steps (5) and (6) will climax the whole operation in a not too distant future.

THE KAJAKAI DAM

The Kajakai Dam, one of the largest of its kind in the world, is considered the keystone of the Helmand Valley development. This rock-and-earth fill structure has created a reservoir with a total capacity of 3,050,000 acre-feet which is much more than the 2,750,000 acre-feet needed for irrigation in the valley. Full head, from tail water elevation to maximum head water, is 271 feet. It has an irrigation tunnel and a power tunnel. A spillway intake has been cut in the rock upstream from the dam; the spillway channel is a natural one. The capacity of the dam allows generation of electricity until a certain surface elevation is reached below which power generation will be at the expense of irrigation water. The power capacity has been estimated to be 252,000,000 KWH in a normal year.

Thus Kajakai Dam is a great source of hydro-electric power as well as a gigantic storage dam. It also controls the floods of early spring which formerly damaged and destroyed lands and properties of the Afghans and Iranians located downstream from it.

IRRIGATION PROJECTS IN THE HELMAND VALLEY

The development of the 55,000-acre Girishk-Kajak and Seraj areas, the 65,000-acre Girishk-Chamalan area, and the 100,000-acre Boghra area was started at the same time as the construction of the Kajakai Dam. The development involved drainage, land levelling, and construction of diversion dams, canals, culverts, siphons, and roads, as required. Some new lands have been distributed among new settlers who were all nomads previously.

Two other areas, the 110,000-acre Garmsel area and the 220,000-acre Chakansur area, have been considered

for development but the actual work has not been started as yet. The same sort of work is contemplated in these areas as has already been started in the smaller areas of the valley. In addition, the alkaline land of the Chakansur area will require leaching and draining to make it arable.

THE ARGHANDAB VALLEY

The Arghandab Valley is at present perhaps the most prosperous valley of Afghanistan. With the completion of modern irrigation projects, Arghandab will be even more prosperous in the near future.

The soil and climate of the valley is suitable for the production of different crops. The fruit of the Arghandab area is excellent and has a ready market inside Afghanistan and in India and Pakistan. A large portion of the foreign exchange of the country depends on the fruit products of the valley.

The shortage of water in the Arghandab Valley has been quite critical and sometimes disastrous in the past. The people of the valley have put large investments in fruit production. For the farmers these investments mean more than just long-term investments; they are their life-time investment. Excessive shortage of water in one year will undoubtedly result in the destruction of fruit gardens and vineyards that have been painstakingly cared for perhaps through the life-time of their owners. That the role that irrigation plays in this valley is of great importance can hardly be exaggerated.

The development project which has been undertaken by the Royal Government of Afghanistan covers the construction of all works necessary to irrigate 120, 000 acres. The work that has been done and is in the process of being performed includes the following:

- (1) Construction of the Arghandab Dam.
- (2) Building new canals and improving old ones.
- (3) Levelling lands.
- (4) Building roads.

THE ARGHANDAB DAM

The Arghandab Dam, which was completed ahead of schedule on September 9, 1952, is a rock-and-earth fill structure. It has a crest elevation of about 1,113.0 meters and holds water to an elevation of 1,110.0 meters. At this elevation the capacity of the reservoir is 350,000 acre-feet. The dam is about 1,700 feet long and rises about 165 feet above the valley floor. The total fill is 1,029,000 cubic meters. An outlet tunnel runs under one end of the dam, through which water is released for irrigation.

The dam has two spillways, the crests of which are excavated into the rock and which are separate from the dam itself. The channels of both spillways are natural ones, and they are confluent so that all flood spill returns to the river through one channel. The construction of these spillways is rather interesting. Scale models of both spillways were made on the project and both quantitative and qualitative tests were run to determine the hydraulic characteristics. For the quantitative tests, the ratio was obtained for the model discharge to a straight ogee crest, and both compared to discharge through a sharp-edged, V-notch weir. In the tests the

(Please turn to page 38.)

It Doesn't Have To Be Hard To Be Good

By DAVE LEWIS M.E. '57

The determination of that illusive property, hardness, has come to be of major importance to the manufacturer, the inspector, the metallurgist and the engineer. The definition of hardness is an illusive proposition in itself! It has become one of the many terms which every layman may use and never be required to explain. Since the engineering and scientific professions thrive on definition, it was mandatory for the pioneers in hardness testing to adequately define that property which they hoped to determine, measure and regulate. Some of the more widely known definitions mention resistance to scratching, abrasion, etc. The classical definition cites hardness as the ability to resist plastic deformation.

Obviously to measure the relative hardnesses of objects, some system had to be devised that would produce a controlled plastic deformation within a material and still eliminate all of the variables within the test itself to assure standardization and the ability to reproduce data. All of the well known hardness testing devices which may be classified as static tests accomplish this through modifications and refinements of the following procedure: A known force is applied to an indenter, which is constructed of a material harder than the material to be tested, and the relative hardness is determined through the ratio of the area of the impression to the load applied.

Unfortunately none of the values of hardness obtained by any existing system possesses units which bear physical significance. It is quickly realized that to correlate hardness with mass, length, and time is a highly theoretical proposition. Each system of hardness numbers selected for any particular type of hardness test is strictly relative and even the magnitudes of the numbers are arbitrary. The project becomes even more confusing when it is observed that the hardness numbers as obtained from different systems can not be interchanged due to their magnitudes and there isn't even a definite proportion existing among them.

For this reason, hardness values may not be used directly as design information. The designer must have a thorough familiarity with any hardness system to which he might refer. Although tables and handbooks exist which correlate the systems, this is not enough to depict the other properties which are inherent at a certain specified hardness. The designer must know his material and how its properties vary with changing hardness before he can gain full benefit from hardness information.

The real need for hardness testing is realized when it is observed that the old maxim, "It has to be hard to be good," doesn't always hold true. For instance, spring steel whose hardness is above certain limits would be too brittle to serve the purpose for which it is intended. Extreme hardness in certain types of bearings and bushings would be prima facie evidence of poor anti-friction qualities. Too great a hardness in material which is to be drawn or extruded is an anathema to the manufacturer.

Often to obtain maximum or minimum hardness in a material is the easiest alternative. The real skill is involved in obtaining hardnesses which are consistently within a specified range. This is one phase in which the engineer and the metallurgist play an important part. The one function where the engineer has full responsibility is the determination of the hardness range that will produce optimum quality within the product.

One might ask why hardness should have such a singular importance when it is such an abstract property. Naturally in some products, especially those which might be classified as tools, the hardness is indeed the paramount consideration. In other materials, however,



It Doesn't Have to Be Hard to Be Good

the hardness may serve as a gauge to measure properties which are even more abstract, such as brittleness, ductility, wear resistance, and resilience. Often, a hardness test is the simplest and the cheapest method of gaining insight to the possession of these properties.

To fully understand the limitations and application of hardness testing it is best to describe the various static hardness tests which exist and are considered as being essential knowledge to the engineer. Of course no one test is perfect or there would be little use to devise so many others. Where a number of factors must be considered it is important to the engineer to be able to select the test most appropriate.

The first of the static hardness tests to gain favor was developed by Brinell and exists in essentially the same form today. The Brinell hardness test employs a hardened sphere as the indenter. For most purposes, a hardened steel is used, but in some applications tungsten carbide is required. This indenter is impressed upon the specimen with a measured force. The most common form of the Brinell hardness test used on semi-hard and hard materials uses a load of 3000 kg and a sphere 10 mm in diameter. The area of the impression made with the Brinell apparatus may be calculated from the diameter of the impression. The diameter of the impression is usually measured with a microscope etched with a millimeter scale. The Brinell hardness number is determined by calculating the ratio of the load to the impressed area.

The prime advantage of the Brinell test lies in the fact that, according to definition, hardness is the resistance to plastic deformation, and the Brinell test is the only test which causes appreciable plastic flow. The Brinell test is well known and popular, so references to hardness on the Brinell scale are nearly universal language among engineers.

The draw backs of the Brinell test exclude it from many uses. Primarily, the Brinell hardness test requires a great deal of time and precision in comparison to some of the more recent innovations. Because it is not

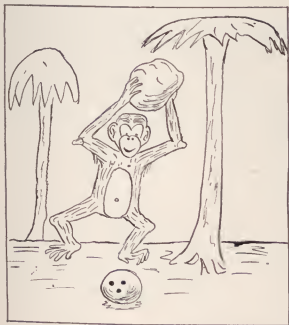
direct reading and because several operations are involved there are many sources of error for inexperienced operators. This, coupled with the fact that the Brinell impression is large enough to constitute a destructive test on many critical items has almost excluded it as a routine inspection machine. Because the load is large and the penetrator is large it may not be used on thin materials, narrow specimens, or materials which have a case hardened surface. Exceedingly hard materials defy accurate appraisal with the Brinell system due to deformation of the indenter.

The Rockwell hardness test ranks second in popularity with the Brinell machine. Although the basic idea is the same, numerous refinements make the two hardly recognizable. The Rockwell tests have achieved great flexibility by employing a number of penetrators and applying a variety of loads. This flexibility pays its price, however, when it is considered that over fifteen Rockwell hardness scales exist, each of which must be designated by its alphabetical prefix to make any Rockwell hardness number have significance.

The Rockwell hardness testers have achieved the maximum in automatic hardness testing. All the operator is required to do is to lift the specimen in place against the penetrator with a screw mechanism until a 10 kg load which "zeroes" the scale is applied. The operator then merely manipulates several levers which apply the major load and retract it after the proper interval. A dial indicator coupled to the penetrator measures the depth of penetration and the hardness value is read directly from the calibrated dial.

The penetrators used in the Rockwell tests are either steel spheres or a conical diamond. The diamond indenter is used for the materials which might be hard enough to cause deformation of the steel. Since the diamond is recognized as the hardest substance known to man it may safely be used on any material. The most popular scale of the Rockwell system utilizes the diamond penetrator, in conjunction with a major load of 150 kg, and is denoted by the prefix letter "C". It must be stressed, that Rockwell scale hardness numbers are valueless unless the prefix letter is included, since this prefix denotes both the type of indenter used and the load applied.

Because of its flexibility the Rockwell system has many advantages. With minor changes, one machine may be used to test the hardest and the softest range of materials. Because the impression is small, a large number of hardness samples may be taken in a small area. Because the loads are not as high as the Brinell tests, and because the cross sectional area of the indenters are much less, the effects of work hardening are not as noticeable following several tests on the same piece. The impressions made by Rockwell hardness tests are large enough to be detected by the unaided eye, but are not as likely to ruin a product in inspection tests as the Brinell. Rockwell hardness tests may be safely conducted on thinner material if the proper selection of load and indenters is made. Special forms of the Rockwell test exist for superficial hardness testing as might be encountered in case hardened and nitrided surfaces.



World's First Hardness Test

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SERVICE YOUR OWN TV SET

By SY MATHEWS B.S.E. '57

The purpose of this article is to acquaint the reader with the general operation of a typical television set and to explain how a set which is not operating properly because of a defective tube may be repaired with a minimum of time and expense.

GENERAL OPERATION OF A TV SET

Every television set is made up of several stages or divisions, each having a definite function and purpose within the set. The individual stages are:

- (1) Antenna
- (2) Tuner
- (3) Video Intermediate-Frequency Stage
- (4) Demodulator
- (5) Video Amplifier
- (6) Sound Intermediate-Frequency Stage
- (7) Audio Amplifier
- (8) Picture Tube
- (9) Horizontal Sweep Stage
- (10) Vertical Sweep Stage
- (11) Synchronizing Stage
- (12) High-Voltage Stage
- (13) Power Supply

When a television station transmits a picture signal, the signal is picked up by the antenna and applied to the set. The signal then progresses through the stages in the set until it produces a picture on the screen and sound from the speaker. Figure 1 shows a layout of the stages.

Antenna—The antenna receives television signals from the transmitter of a television station as high-frequency, electro-magnetic waves. The waves are modulated with the actual picture and sound information in which the TV viewer is interested; that is, the electro-magnetic waves act only as carriers for the real signal in order to convey the signal through the air to the antenna. The waves cause varying electric currents in the antenna. Wires transport these currents to the tuner of the set.

Tuner—The tuner selects a particular group of currents which contain the information transmitted by one station, from the currents produced in the antenna. The selected signal is then reduced to lower carrier frequencies by means of an oscillator so that it may be amplified in later stages.

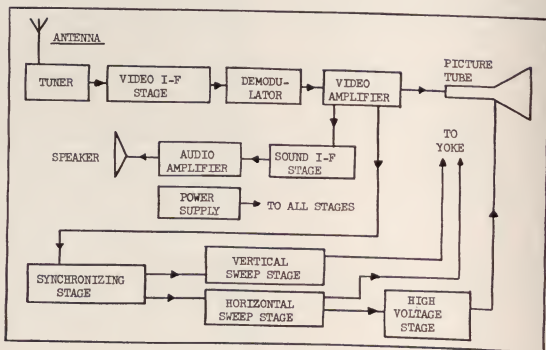


Figure 1. Block Diagram of a Television Receiver

Video Intermediate-Frequency Stage—The video intermediate-frequency stage receives the signal from the tuner and amplifies it. Three or four tubes, located in this stage, amplify the signal to a magnitude hundreds of times greater than the magnitude of the input signal.

Demodulator—The demodulator, after receiving the signal from the intermediate-frequency stage, removes the picture and sound information from the high-frequency carrier, which has carried the signal through the previous stages. When the signal leaves the demodulator, it is composed of electric currents which vary both in magnitude and frequency. The frequency range of the currents lies between zero and six megacycles per second.

Video Amplifier—The video amplifier receives the demodulated signal and amplifies it. At the output of the video amplifier, the signal is divided into two separate signals—the picture signal and the sound signal. The picture information is applied to the picture tube and the synchronizing stage while the sound information is applied to the sound intermediate-frequency stage.

Sound Intermediate-Frequency Stage—The part of the output signal from the video amplifier containing sound information is fed to the sound intermediate-frequency stage. The actual sound or audio signal is carried through this stage on a carrier frequency of four and one-half megacycles per second. After the signal has been amplified, the audio information is removed from the carrier and is applied to the audio amplifier.

Audio Amplifier—When the audio signal enters the audio amplifier, it is too weak to produce sound from the speaker of the set. Therefore, it is amplified and then applied to the speaker.

The speaker works on the principle that a varying electric current passing in a wire through a magnetic field produces a force on the wire proportional to the change in the current. The wire is wound into a coil and placed in a magnetic field produced by a permanent magnet. The coil of wire is connected to a diaphragm (figure 2). When the coil is forced to move because of the varying currents in the coil, the diaphragm is forced to move proportionally. Motion of the diaphragm produces variations in the pressure of the air around the speaker, and sound is produced.

Picture Tube—The shape of the picture tube is widely different from that of any other electronic tube. The tube itself is usually made of glass, so that a large screen appears at the face of the tube. Figure 3

shows a side view. A phosphorescent coating is sprayed on the inside of the screen. A metallic film is applied to the inside of the cone. The neck, gun and socket are assembled as another unit. The gun consists of a filament, cathode, control grid and two anodes. The region around the tube is evacuated and the glass neck is fused to the cone. The tube is then ready for use.

The tube operates on the principle that an electron beam, travelling in a vacuum, will cause a spot of light to appear on a phosphorescent surface when the beam strikes the surface. The intensity of the electron beam determines the brightness of the spot, and the properties of the phosphorescent material determine the color of the spot. When the filament heats the cathode to a sufficiently high temperature, the cathode emits a cloud of free electrons. The two anodes, mentioned above and another anode made up of the metallic film on the inside of the cone, which are at potentials much higher than that of the cathode, accelerate the electrons into a single beam and direct the beam toward the screen. At the same time the control grid acquires a variable potential with respect to the cathode and causes the intensity of the beam to vary accordingly.

If the tube is operated as stated above, a spot of light of varying intensity will appear at the center of the screen. In order to receive a picture on the screen, the spot of light must be moved swiftly in the vertical plane. This can be done by placing a yoke coil around the neck of the tube and up close to the cone. When variable currents are sent through the yoke coil, the electron beam within the tube will move vertically and horizontally at the same time. The single spot moves so fast that persistence of vision makes the screen appear as though it were covered with light. The spot starts at the top left corner of the screen and travels to the lower right corner by the same route that words follow on a printed page. The process is then repeated.

When the currents in the yoke coil and the variable voltage on the control grid are synchronized properly, a picture will appear on the screen.

Horizontal Sweep Stage—The currents, which pass through the yoke coil in order to move the beam of light on the screen in a horizontal direction, are produced in the horizontal sweep stage. An oscillator produces a sawtooth wave, which, after being amplified and passed on to the yoke, causes the electron beam in the picture tube to move back and forth horizontally.

(Please turn to page 30.)

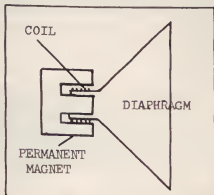


Figure 2. Speaker

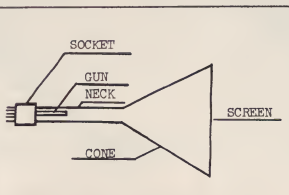
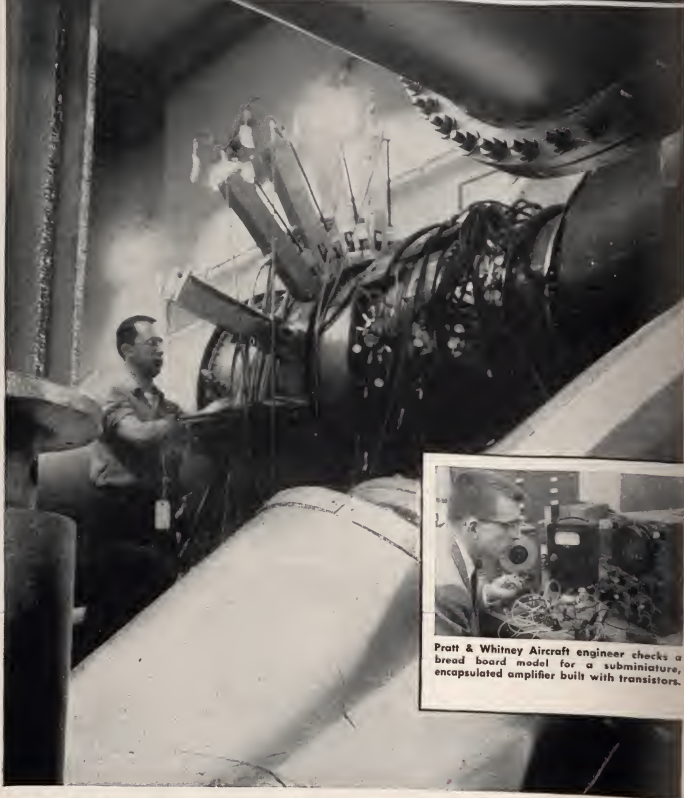


Figure 3. Picture Tube

WHAT'S DOING at Pratt & Whitney Aircraft...



Pratt & Whitney Aircraft engineer checks a bread board model for a subminiature, encapsulated amplifier built with transistors.

A rig in one of the experimental test cells at P & W A's Willgoos Laboratory. The six large finger-like devices are remotely controlled probe positioners used to obtain basic air flow measurements within a turbine. This is one of the techniques for obtaining scientific data vitally important to the design and development of the world's most powerful aircraft engines.

...in the field of INSTRUMENTATION

Among the many engineering problems relative to designing and developing today's tremendously powerful aircraft engines is the matter of accumulating data — much of it obtained from within the engines themselves — and recording it precisely. Such is the continuing assignment of those at Pratt & Whitney Aircraft who are working in the highly complex field of instrumentation.

Pressure, temperature, air and fuel flow, vibration — these factors must be accurately measured at many significant points. In some cases, the measuring device employed must be associated with special data-recording equipment capable of converting readings to digital values which can, in turn, be stored on punch cards or magnetic tape for data processing.

Responsible for assembling this wealth of information so vital to the entire engineering team at

Pratt & Whitney Aircraft is a special group of electronic, mechanical and aeronautical engineers and physicists. Projects embrace the entire field of instrumentation. Often involved is the need for providing unique measuring devices, transducers, recorders or data-handling equipment. Hot-wire anemometry plays an important role in the drama of instrumentation, as do various types of sonic orifice probes, high temperature strain gages, transistor amplifiers, and miniaturized tape recording equipment.

Instrumentation, of course, is only one part of a broadly diversified engineering program at Pratt & Whitney Aircraft. That program — with other far-reaching activities in the fields of combustion, materials problems, mechanical design and aerodynamics — spells out a gratifying future for many of today's engineering students.



Instrumentation engineer at Pratt & Whitney Aircraft is shown investigating modes of vibration in a blade of a single stage of a jet engine compressor.



Special-purpose probes designed and developed by P & W A engineers for sensing temperature, pressure and air flow direction at critical internal locations.



The "Plottomat", designed by P & W A instrumentation engineers, records pressure, temperature and air flow direction. It is typical of an expanding program in automatic data recording and handling.



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OUT OF THE BRIEFCASE

LIQUID METAL PUMP

The development of nuclear reactors for public power was speeded this year when the Westinghouse Atomic Equipment Department developed a mechanical liquid pump for high temperature operation. The pump completed a 500-hour performance test run early this summer at more than 1000 degrees F. — the highest temperature at which a pump of this type has ever operated for an extended time. The pump is rated at 150 gpm at a 285-ft. head.



The new centrifugal pump has a hermetically-sealed rotor containing both pump and motor in a single unit. The pumped fluid and the rotating parts of the pump and motor are insulated from the field windings and the atmosphere in this manner. Insulation is of primary importance in nuclear reactors which contain contaminated fluids.

Production models of the pump will operate at temperatures up to 1600 degrees F., and will be applied to nuclear power plants and other applications requiring high-temperature heat-transfer mediums.

DECORATIVE STEEL COATING

A new product, combining the structural strength of steel with the rich decorative effects of vinyl plastic in an almost limitless variety of colors and textures, has graduated from the research laboratory and is now in experimental production at U. S. Steel's Irvin Works near Pittsburgh, Pennsylvania.

Liquid plastic is coated on cold-reduced steel sheets to produce an appealing, tough-surfaced sheet of beauty and durability. New decorative effects in such equipment as refrigerators, radio and TV cabinets, wall panels and automotive bodies are now feasible.

In manufacture, steel sheets are treated to improve the bonding quality, a specially compounded adhesive is applied and is then cured by heating. After air-cooling, the steel enters a coating chamber where the thermoresponsive vinyl plastic is applied to the adhesive-coated surface. Again, heat is applied to solidify the plastic. Prior to cooling, the vinyl coating is embossed to obtain the desired design. The finished product is stacked by a magnetic piler.

The coating has excellent abrasion resistance and good electrical resistance properties. It is unaffected by humidity and many chemicals. The coating produces sound-deadening effects which will have value in acoustical design.

The new product can be supplied in any color and can be utilized in manufacturing many parts which heretofore required protective or decorative finishes. Elimination of post-fabrication treatment will result in lower cost and increased wearing quality.

JET VANE MACHINE

An unusual manufacturing method, five years in development, is used by Pratt & Whitney Aircraft to insert jet-engine vanes into metal shrouds.

The Danly vane-piercing machine makes the new method possible. The machine literally stabs the vanes into the shrouds much like a straw blown through a tree trunk during a hurricane.

The new machine was developed to replace the long-established shop technique of metal piercing metal for vane fitting. In the metal piercing metal technique, the shroud was pierced with a punch, the punch removed and the vane fitted in place. This method was not exact enough to meet design considerations. As many as 11 shrouds and 1,000 vanes are used in one engine. One of the main troubles was the variation in vane stock, originated in rolling; this later caused loose fittings.

A method was sought by which each vane could be its own punch and gage. Tolerances could be eliminated, unusual in a field where tolerances are unusually close.

The Danly Machine Specialties, Inc., designed a stabbing machine which was put into trial operation for a period of two years. After minor modifications and changes, the machine was put into part-time production.

The machine is hydraulically operated, weighs seven tons, and exerts a pressure of four tons. The stabbing is performed horizontally. With a circular shroud in place, the vanes are stabbed in radially from the center of the shroud. The vanes are fed into the machine from a vertical feeder and are then rammed into the shroud. In this completely automatic operation, the velocity of the vanes is six inches per second. In a later manufacturing step, the vanes are driven through a second skin overlaying the first.

Meet Dick Foster

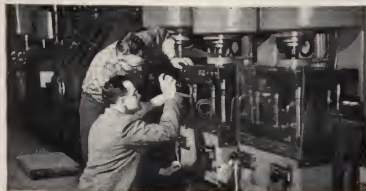
Western Electric development engineer



Dick Foster joined Western Electric, the manufacturing and supply unit of the Bell System, in February 1952, shortly after earning his B. S. in mechanical engineering at the University of Illinois. As a development engineer on a new automation process, Dick first worked at the Hawthorne Works in Chicago. Later, he moved to the Montgomery plant at Aurora, Illinois where he is pictured above driving into the parking area.



Dick's day may begin in one of several ways: an informal office chat with his boss, a department "brain session" to tackle a particularly tough engineering problem (above); working with skilled machine builders in the mechanical development laboratory; or "on the line" (below) where he checks performance and quality and looks for new ways to do things.



Here Dick and a set-up man check over the automatic production line used to manufacture a wire spring relay part for complex telephone switching equipment. This automatic line carries a component of the relay on a reciprocating conveyor through as many as nine different and very precise operations—such as percussive welding in which small block contacts of palladium are attached to the tips of wires to within a tolerance of $\pm .002$ ".



Examining the plastic molded "comb" components of the wire spring relay Dick recalls his early work when he was involved in working-up forming and coining tools for the pilot model of the automation line for fabrication of wire spring sub-assemblies for relays. At present he is associated with the expansion of these automation lines at the Montgomery Plant.



Dick finds time for many Western Electric employee activities. Here he is scoring up a spare while tuning up for the engineers' bowling league. He is active also in the golf club, camera club, and a professional engineering society. Dick, an Army veteran, keeps bachelor quarters in suburban Chicago where he is able to enjoy the outdoor life as well as the advantages of the city.

Western Electric offers a variety of interesting and important career opportunities for engineers in all fields of specialization in both our day-to-day job as the manufacturing and supply unit of the Bell System and in our Armed Forces job.

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ALUMVIEWS

PRESIDENT'S MESSAGE

By FRANK T. MITCHELL, JR.

President, Engineers' Alumni Association

It is a great pleasure for me to greet you on the occasion of the first issue of the new year of *Mecheleciv*. During the school year, this column will be used to keep you informed about the activities of the Association and to report the happenings of our fellow graduates of the School of Engineering.

With the opening of Tompkins Hall this fall for classes, the School of Engineering — 1060 strong — begins a new era. The Engineer Alumni Association will itself join with the School in facing these new challenges and opportunities.

To carry out this important assignment and make a definite contribution to the betterment of our Alma Mater, the Engineer Alumni Association must be a vibrant and active organization. That means that every Engineer alumnus must support the Association as a dues paying member and as active workers.

Your leadership for the coming year will be in the hands of capable and interested alumni. My fellow officers in the Association include:

Carl H. Roeder, Vice President;
John P. Conner, Secretary-Treasurer;
Wallace G. Kistler, Corresponding Secretary.

Members of the Executive Committee include: Warren C. Crump, Reuben F. Leatherwood and Harry C. Connor.

In the next few weeks you will receive a dues announcement for the coming year. I hope that you will acknowledge this notice immediately and include in it your subscription to *Mecheleciv*.

In this way, your Engineer Alumni Association can get the year started on a strong footing and can do more of the School of Engineering family, to be of service to you as a member

ALUMNI NOTES

A. A. Lahna (BME, '43) has moved to Florida to become Mechanical Division Chief of a new office of the H. K. Ferguson Co., Industrial Plant Designers. Their largest present project is a tractor assembly plant for the Caterpillar Tractor Co.

Col. George W. Easterday, U.S.A. Retired, (BSEE, '09) commends George Washington for the background which made it possible for him to become an officer in the U. S. Army. Col. Easterday was awarded two silver stars in World War I, and in World War II he received the War Department Commendation Medal.

Donald Keever (BSEE, '56, Theta Tau) is now attending fire control system school at Hughes Electric Co. Don is working in Technical Liaison, and after finishing school he will go to Palmdale in the Mojave Desert. He, Sam Mawhood ('56) and Casey Mohl ('55) have a flourishing poker club with this nucleus.

(Please turn to page 32.)

3 BIG STEPS

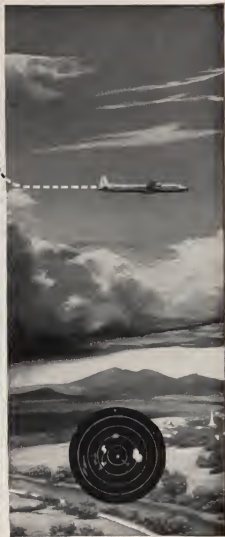
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RADIO CORPORATION OF AMERICA

ELECTRONICS FOR LIVING

CAMPUS NEWS

ASCE

Members of ASCE and guests enjoyed a brief respite from the heat this summer by attending the annual picnic held at Great Falls National Park on the Maryland side of the Potomac River.

Various executive sessions were held throughout the summer to prepare a better format for future meetings throughout the coming semester.

Of importance to the members and prospective members is the monthly award of a luncheon ticket to the Society's monthly luncheon and get-together that is held at the Y.W.C.A.

In addition, the regular meetings are going to be restricted to programs only except for the night of election of officers.

Arrangements are being made for the October meeting through Commander Downen of the Bureau of Ships for a speaker on "The Atomic Sub." The United States Steel Corporation has consented to provide a speaker and slides for the November meeting — the topic to be "Long Span Steel Joists." Maloney Concrete Company of Washington is arranging an interesting program for the December meeting on "Concrete Products and Mixes."

ASCE's program for the weekly Lyceum to be held October 23 in the Audio-Visual Room of Tompkins Hall will be a movie on "Construction Projects in Afghanistan."

ASME

The American Society of Mechanical Engineers held its elections at the end of the Spring semester at which time they elected or appointed the following officers:

Chairman: Bill Mulkey
Vice Chairman: Dave Lewis
Secretary: Orron Kee
Treasurer: Frank Ryerson
Program Chairman: John Cannon
Engineers' Council Rep.: Howard Davis
Publicity: Dick Houghton
New Members: John Jones
Honorary Chairman: Benjamin C. Cruickshanks

The executive committee met during the summer to plan the winter program and to revise the by-laws and bring them up to date. An initial contact was made with all incoming freshmen M.E.'s introducing the freshmen to registration procedure and to the ASME.

AIEE - IRE

For the benefit of the new students the AIEE-IRE is the joint student branch of the American Institute of Electrical Engineers (AIEE) and the Institute of Radio Engineers (IRE). The objectives of both of these organizations are to advance the art and science of electrical and communications engineering and also to promote the professional welfare of the engineers engaged therein. The joint student branch at George Washington endeavors to accomplish these same aims as well as having a program of guest speakers at the monthly meetings to present ideas on current developments within the electrical and communications fields.

All electrical engineering students are invited to join either one, or both of the student branches.

An organizational meeting of the AIEE-IRE was held during the past July. All officers and faculty advisors were present. Plans and policy for the forthcoming semester were discussed. Particular interest was given to the program of guest speakers and the manner of selection of the student to receive the competitive prize.

The guest speaker at the first meeting this semester, October 3rd, will be Dr. J. W. Siry of the Naval Research Laboratory. His subject, the "Vanguard" project, is both timely and interesting.

ENGINEERS' COUNCIL

The first big Council-sponsored event is coming up soon: the Engineers' Mixer. New students attending this informal affair will be getting acquainted with their professors and student leaders while the experienced engineers will be consuming the coffee, coke and sandwiches. Every engineer is invited, so mark the date: Friday, October 12 at 8 p.m. in Lisner Lounge.

A new idea is taking hold this semester — a weekly lunchtime lyceum — educational entertainment during lunch. Movies and speakers will be sponsored by ASME, Theta Tau, AIEE-IRE, ASCE, and Sigma Tau, in rotation.

The fourteen council committees have worked hard this summer. High points: the committees detailed an \$8,000 budget, planned an engineers' float for the homecoming parade, and secured Arlington Towers and Joe Maguire's orchestra for the spring Engineers' Banquet and Ball.

(Please turn to page 28.)

ENGINEERS...

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Knowledge of or experience in dynamics, stress analysis, servo-mechanisms, heat flow and circuit analysis or non-linear mechanics is helpful.

CAMPUS NEWS

(Continued from page 26.)

SIGMA TAU

To further its policy of cooperation with the Dean of the School of Engineering, Sigma Tau Fraternity will henceforth require its initiates to take diagnostic tests beginning November 10, 1956. These tests will be used for the purpose of determining a student's abilities and aptitudes, and will also be given to probationers and freshmen entering the University. Data obtained from Sigma Tau members will serve as a control to help in evaluating the results of these tests. However, the tests are open to all students so here is an excellent opportunity to determine your standing in the group. Individual test results are kept confidential.

THETA TAU

At the close of the Spring semester, a shrimp feast was held at the home of Professor Ames. The feast was held as a farewell party for Brother Ames who was leaving for Ceylon.

The annual family picnic was held July 14 at Fort Washington. The activities of the day included a softball game between actives and alumni, horseshoe pitching, and bingo. The active members were pleased with the turnout of alumni and hope that the alumni will become more active throughout the coming year.

A beer bust was held September 7 at the Phi Sigma Kappa house. Prospective pledges were invited to the beer bust and a good time was had by all.

As the new school year starts, the chapter is looking forward to a successful and eventful year.

STUDENT HANDBOOK

The *Engineers' Guide*, a student handbook designed specifically for the engineering student, was printed in time to be handed out to the students at registration time. The *Guide* was the product of a staff of students under the direction of Editor Ray Sullivan and Business Manager Vince Rider and represents a good many hours that otherwise would have been devoted to summertime leisure. As the first effort of this type in the School of Engineering, the book was intended to fill a need in orienting the new students in the ways of GW and to provide the older students with a handy pocket guide to activities of the School. How well it succeeded can undoubtedly be best answered by the students themselves. Any comments or criticism, or suggestions for improvement of next year's edition can be turned in at or mailed to the *Mecheleciv* Office. Extra copies of the handbook can also be obtained in the *Mecheleciv* Office.

HARDNESS

(Continued from page 17.)

The Vickers Hardness Testing Machine is one of the newer types. It uses a pyramid shaped diamond indenter which may be applied under a variety of loads. The width of the indentation as measured across the diagonals is the basis of the Vickers Pyramid Number. This diagonal width as measured with an optical micrometer may be determined with greater accuracy than the diameter of the impression produced by a Brinell test. The impression produced by the Vickers machine is generally too minute even to be detected by the naked eye, and is therefore strictly non-destructive. Because of the precision inherent with the advanced design of the Vickers machine, and the accuracy and care with which the components are assembled, it is considered to achieve the ultimate accuracy for the hardness testers capable of being applied to routine assignments. The Vickers Pyramid hardness number scale is uniquely arranged in that a number may be duplicated with a series of loads of different magnitudes. This eliminates much of the confusion which arises from the profusion of scales which must accompany the Brinell and Rockwell values. The Vickers machine has remarkable flexibility because of the many design features it possesses. It may be used for practically any type of material and may be applied to almost any type of heat treatment technique or case hardened surface. With ingenuity, the Vickers impressions may be made with accuracy on any reasonable manufactured shape without destruction.

The major drawback of the Vickers system is the cost of the machinery and the precision and skill which is required of the operator.

Another type of hardness tester which is similar in design to the Vickers is the Knoop-Tukon Hardness Tester. Actually this is a micro-hardness testing device in that the Knoop indenter, which is a pyramid ground diamond, is many times smaller than even the Vickers penetrator. This indenter is so small that when coupled with the microscope of the Tukon machine it is possible to test the hardness of adjacent crystals in the same material. Its practical applications are limited to extremely small parts such as watch and instrument assemblies. Primarily the device is restricted to laboratory work and is a valuable tool to the metallurgist.

Hardness testing and the property of hardness itself are of great importance to the engineer, whatever his major might be. A thorough knowledge of the available tests and an adequate understanding of test results has been a big factor in the development of better and more economical products.

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The rifle barrel steel that makes hunting more fun

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Steels normally used for lightweight barrels gave all kinds of trouble to the gunsmith: distortion, poor finish, high tool costs, trouble with drilling, reaming, rifling. They took this problem to Timken Company metallurgists—and got the perfect solution.



This TIMKEN® rifle barrel steel is free from internal stresses

Developed by the Timken Company, this new steel (center barrel, in picture) made possible a rifle barrel 6" shorter, 2 lbs. lighter than the previous barrel of the same caliber (left). It withstands the wear of thousands of rounds of firing. Machines to highest accuracy—and to high finish beauty. Machines without distortion. Drills, reams and rifles perfectly. Proof tests to 70,000 lbs. per sq. inch for safety in a .30/06. Has handled overloads up to 100,000 lbs. per sq. inch. Timken Company metallurgists are leading specialists in fine alloy steels . . . as this remarkable new steel will testify.



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TV SERVICING

(Continued from page 19.)

Vertical Sweep Stage—An oscillator in the vertical sweep stage produces another sawtooth wave, similar to that produced in the horizontal stage — but lower in frequency. This wave, after being amplified and passed on to the yoke, causes the electron beam in the picture tube to move up and down.

Synchronizing Stage—The synchronizing stage receives its signal from the output of the video amplifier stage. The signal itself contains pulses of current which, when applied to the horizontal and vertical sweep stages, keep the respective oscillators operating at their proper frequencies. The synchronizing stage removes these pulses from the picture signal and applies them to the sweep stages.

High-Voltage Stage—To cause the picture tube to operate properly, a voltage of about 16,000 volts must be applied to the anode on the inside of the cone of the tube. The high-voltage stage is especially designed to produce this voltage. Taking part of the signal from the output of the horizontal amplifier, the high-voltage stage amplifies the signal to produce the necessary 16,000 volts.

Power Supply—The power supply is the most important stage of the set. It produces currents to heat the filaments of the tubes and voltages to operate the tubes.

SERVICING THE TELEVISION SET

Whenever a television set stops operating properly, it becomes necessary for someone to replace a defective part in order to make the set function properly again. In about 80% of the cases, the trouble can be attributed to a defective tube. The following discussion deals with methods of finding and replacing defective tubes.

Methods of Locating a Defective Tube—By recognizing that the set is not working properly and associating the problem with a particular stage in the set, an individual can reason that a defective tube lies in that stage. Since there are usually no more than three tubes in any one stage, the possibility of finding the faulty tube is greatly increased. All of the tubes in the stage should be tested; in this way, the defective one can easily be singled out and replaced.

Associating a problem with a particular stage may be illustrated as follows:

- 1) If the set is completely dead — no sound, no picture, no light on the screen — the power supply is not operating properly. This must be the case since every operation within the set depends on the power supply and since there is no other stage which can cause failure of all the rest of the stages.
- 2) If there is a good picture, but no sound, the trouble lies in the sound intermediate-frequency stage or the audio amplifier, both of these stages should be checked.
- 3) If the picture contains snow, the trouble is in the tuner, antenna, or the first tube of the video intermediate-frequency stage. Snow is an indication of a weak signal being fed to the set; therefore, something must be weakening the signal at or near the input of the set.
- 4) If the picture rolls up or down, the defect lies in the synchronizing stage. The vertical oscillator is operating at an improper frequency. Likewise,

if the screen appears to be matted with irregular black and white lines, the horizontal oscillator is working at an improper frequency. In this case, the synchronizing stage is also the source of trouble.

- 5) If sound is present, but no light is on the screen, the defective tube lies in the horizontal sweep stage, the high-voltage stage or the picture tube. When a problem of this sort occurs, an interesting test will reveal which of the stages is at fault. The horizontal sweep stage and the high-voltage stage each contain a tube which has its anode exposed on the top of the tube as a top cap. When a metallic object is placed close to either anode, an electric arc will protrude from the anode to the metallic object if both stages are operating properly. In this case, the picture tube is at fault. If an arc is obtained from neither anode, the horizontal stage is at fault. If an arc is obtained from only one of the anodes, the high-voltage stage is at fault.

When an intermittent problem arises in a set, the procedure for finding the defective tube within a stage does not involve testing the tubes. A tester will seldom indicate that an intermittently bad tube is defective. Another troubleshooting method is necessary. This method involves tapping the individual tubes in the stage and watching for any operational change in the set. If a change in the behavior of the set is noticed when a particular tube is tapped, the defective tube is located.

Location Charts, Locating tubes that belong to a particular stage may sometimes be troublesome. In many television sets, a chart, giving the location, number and function of each tube, is attached to the inside of the cabinet. In most sets, however, no such chart exists; but, one may be obtained from an electronic wholesaler for a nominal charge.

Jumper Cord, When the back of the set is removed, the line cord, supplying the power to the set, is usually automatically disconnected. It is sometimes desirable to have the set turned on while the back is off; a jumper cord makes this possible.

RECOMMENDATIONS

Great care should be taken when an attempt is made to repair a television set. Some of the precautions are:

- 1) Keep hands away from high-voltage wires. The high voltage is not necessarily a shock hazard, since the current is small; however, a natural reaction to a shock is to jerk the hand out of the set swiftly. This can cause deep, painful cuts on the hands in many instances.
- 2) Replace tubes in their proper sockets. A misplaced tube can cause serious damage to other parts in the set.
- 3) Do not attempt to repair a set with a do-or-die attitude. The defect may be in some part other than a tube. In this case, time will be wasted and much energy expended.

This report applies to black and white receivers, but not to color sets. It is recommended that no attempt be made to repair a color receiver unless a great deal more knowledge is acquired. Color sets challenge even the experts.



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PAID ALUMNI

The names listed below are those alumni who had contributed the \$2.00 *Mecheleciv* subscription fee prior to the copy deadline for this issue. The subscriptions have been coming in quite a bit slower than we had expected. Perhaps this is due to summer doldrums, in any event, we would like to see a big jump in the number of checks arriving at the office after this issue is mailed. At our present size the alumni copies cost us in the neighborhood of \$1300.00 a year just in printing costs.

When we are considering the foregoing facts we always feel doubly grateful to our alumni such as those listed below who not only help us out financially but also send in an amazing number of suggestions and criticisms. It's true that a number of these fall into the "keep up the good work fellas" theme but many of them are well-thought-out suggestions from men of seasoned judgment and a few, with or without an enclosed subscription fee, are downright acrimonious. All types are welcome because they are our only contact from most of the alumni and therefore have to be used as practically our only indicator as to what we are doing right or wrong.

Aaron, H.—Washington, D. C.
Abramson, N.—Silver Spring, Md.
Albert, F. M.—Washington, D. C.
Allen, J. B.—Washington, D. C.
Bailer, E. F.—Silver Spring, Md.
Baker, E. A.—Silver Spring, Md.
Ball, E. M.—Eureka Springs, Ark.
Banker, R. E.—Washington, D. C.
Beatty, R. W.—Boulder, Colo.
Beers, J. S.—Rockville, Md.
Berdick, M.—Yonkers, N. Y.
Bondy, M. F.—Tomawanda, N. Y.
Boyd, J. R.—Silver Spring, Md.
Brady, D. S.—Albany, N. Y.
Breezeale, J. A.—Washington, D. C.
Brown, L. R.—Berwyn, Pa.
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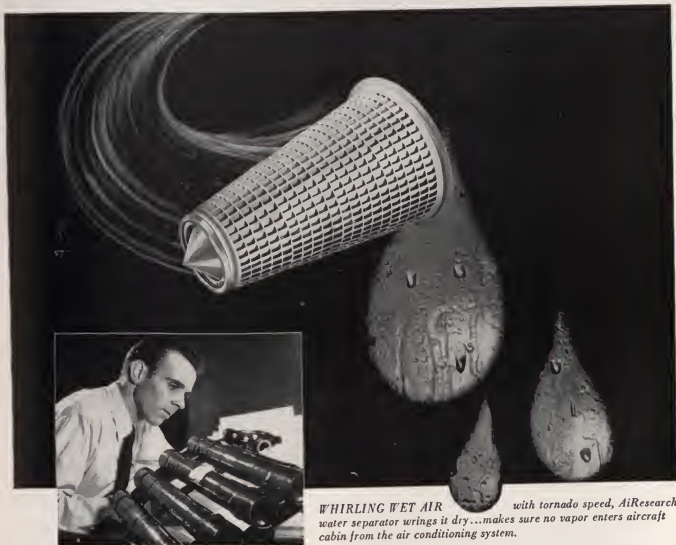
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Crump, W. C.—Washington, D. C.
Dimmette, C. C.—Hyattsville, Md.
Drysdale, J. M.—Washington, D. C.
Dutton, D. L.—Newark, Del.
Easterday, G. W.—Coronado, Calif.
Egloff, E.—Arcadia, Calif.
Engen, Gilbert A.—Washington, D. C.
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Falco, M.—Phoenix, Ariz.
Fischman, M.—Washington, D. C.
Flieger, H. W. Jr.—Wash., D. C.
Freehof, H. B.—Washington, D. C.
Freeman, J. T.—Washington, D. C.
Geist, J. H.—Fort Belvoir, Va.
Geyer, W. T.—Albuquerque, N. M.
Girouard, P. H.—Washington, D. C.
Grayson, H. A.—Washington, D. C.
Griffin, C. W. Jr.—Erlton, N. J.
Hand, E. J.—Washington, D. C.
Hanrahan, D. J.—Falls Church, Va.
Harbaugh, Y. D.—Washington, D. C.
Harris, W. C. Jr.—West Allis, Wis.
Hekiman, N. C.—Silver Spring, Md.
Hermach, F. L.—Silver Spring, Md.
Hill, E. W. Jr.—Wilmington, Del.
Johnson, D. P.—Falls Church, Va.
Johnson, R. C.—Moline, Ill.
Jones, I. K.—Cincinnati, Ohio
Keever, Don—Los Angeles, Calif.
Lahna, A. A.—Fort Lauderdale, Fla.
Lecraw, J. E.—Old Westbury, N. Y.
Lippitt, E. G.—Charleston, W. Va.
Loose, W. W.—Reading, Pa.
Ludlow, L. L. Jr.—Falls Church, Va.
Lynch, R. M.—Annandale, Va.
Manville, R. W.—Washington, D. C.
Martin, J. L. Jr.—Richmond, Calif.
McCalip, C. E.—Arlington, Va.
Motz, C. A.—Los Angeles, Calif.
Muth, R. F. Sr.—Mount Wolf, Pa.
Parks, A. B.—Bladensburg, Md.
Parrott, W. M.—McLean, Va.
Parsons, J. E.—Washington, D. C.
Percival, W. A.—Southwick, Mass.
Pindell, W. H. Jr.—Washington, D. C.
Pynn, G. W.—Woodstock, N. Y.
Reddle, V. L.—Falls Church, Va.
Reed, W. L. Jr.—Dayton, Ohio
Reznek, J.—Washington, D. C.
Rockowitz, J. B.—Chula Vista, Calif.
Roeder, C. H.—Silver Spring, Md.
Roetter, P. H.—Silver Spring, Md.
Roettiger, H. A.—Arlington, Va.
Schmitt, E. A.—Chevy Chase, Md.
Shepherd, W. D.—Pittsburgh, Pa.
Shimkus, D. F.—Worcester, Mass.
Sigler, P. A.—Washington, D. C.
Staubly, A. M.—Minneapolis, Minn.
Stephenson, E. D.—Pittsford, N. Y.
Surne, R. T.—Silver Spring, Md.
Thomassom, H. B.—Arlington, Va.
Thompson, R. F.—Alexandria, Va.
Tompkins, R. L.—Falls Church, Va.
Urbine, C. A.—Arlington, Va.
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OCTOBER 1956

PATENTS

(Continued from page 13.)

(c) **Objects of Invention** — Here the inventor states what he proposes to accomplish by his invention. The discussion of the objects is called the "statement of invention" as discussed in (b) above.

(d) **Description of the Drawings** — In this section, a very brief statement concerning each drawing is given. A full explanation is given in the next section, "The Disclosure."

(e) **The Disclosure** — The law requires that the patent contain a full disclosure of the invention, and, as we have seen, in such "full, clear, concise, and exact terms so as to enable anyone skilled in the art to which it appertains to make, construct, or compound the same." The discussion of the objects serves in part to comply with this requirement and in order to further comply, the specification of the patent proceeds with a description of an embodiment of the invention. The inventor, of course, selects for exemplification in the patent the best mode he knows for carrying out the invention. By doing so, however, he does not commit himself to a limitation in the sense that the invention may not be embodied in another and better way than that which he has selected for exemplification. A carefully written specification guards against the implication that the invention might be limited to the concrete exemplification by stating that the drawings show a "preferred" embodiment of the invention. This is in itself, an important point.

(f) **The Claims**—A claim is a definition of the disclosed invention, and, in formulating such a definition, the inventor will withdraw more or less from the embodiment of the invention which he has described. For instance, he may not call a spring a spring but resilient means; thus, the claim, if the state of the art allows, may be couched in general rather than specific terms.

The inventor is required by statute to "particularly point out and distinctly claim the part, improvement, or combination which he claims as his invention or discovery." To one not versed in the function of the claims and reasons therefore, these claims appear to be such a conglomeration of abstractions and legal verbiage as to be not only unintelligible but to be far from telling what the invention is. It must be remembered that the claims are not written for the purpose of describing or explaining the invention. The only function of the claims is to lay an exact boundary of the ground forbidden to others. If there were no claim or claims, the inventor could assert his right of exclusion against supposed infringers entirely at his pleasure and in a most high-handed manner. As various questions of infringement arose, he could also be free to change his mind from time to time as to what he had intended to claim.

PATENT FALLACIES

Perhaps the most common of all fallacies concerning inventions is the one that if a man invents something entirely new, the world will beat a path to his door. However, think of the disheartening difficulties encountered by Bell and his telephone, the Wright brothers and their airplane and others in that category. Despite the fact that their inventions were to change the course of world history, they were anything but readily accepted.

In almost every case then, it seems that any inventor must overcome the apathy and inertia of a stubborn world before being permitted to utilize his invention in a commercial sense.

It should be noted that by far the greater number of inventions are not basic or pioneer inventions, but improvements on existing apparatus or methods. Many conditions must be met to obtain an improvement patent on basic inventions.

Another fallacy, closely allied to the first, is that the easiest road to wealth for an inventor lies in acquiring a patent. The patent of itself does not bring wealth. At the present time the United States Patent Office issues between 800 and 1,000 patents a week. We are not making men wealthy at that rate. Over 600,000 patents have been issued in the past 15 years.

A third fallacy, a most important one and recurring again and again, is the notion that a patent grants its owner the right to manufacture the patented article. A patent for a mousetrap gives the owner the right to use the courts to prevent others from using, making, or selling mousetraps embodying the features claimed in his patent. Someone else may hold patents covering certain features of the patented mousetrap, and they have a similar right to prevent anyone else, including the inventor of the improved mousetrap, from utilizing these patented features during the life of these patents. For example, Mr. A obtains a patent on an improved mousetrap which includes a special spring. Mr. B holds a patent covering the special spring. Therefore, Mr. A cannot make, use, or sell his patented mousetrap without infringing Mr. B's patented spring. Mr. A's patent does not give him the right to manufacture his patented mousetrap unless he gets a license from Mr. B.

SUMMARY

An inventor can obtain a patent on a machine, process, article of manufacture, or composition of matter, or any new and useful improvement thereof subject to the following conditions and requirements.

- (a) He must be the first inventor.
- (b) The patent must be applied for within one year of its first publication, public use, sale, or patenting in a foreign country.
- (c) The patent application must meet the rules as to form as laid down by the Patent Office.
- (d) The applicant (inventor) may prosecute his case (application) before the Patent Office; however, a patent agent or attorney is usually engaged to conduct the prosecution, therefore, ask your attorney — but make your own final decisions.

It is hoped that this article may be helpful in explaining the history, need, function, and activities of our patent system and also in clearing up any fallacies of the system that may have been in the reader's mind. We believe that Abraham Lincoln was quite correct when he suggested that, "The Patent System added the fuel of interest to the fire of genius."

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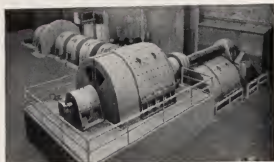
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Or, if you have decided your field of interest and are well qualified, opportunities exist for direct assignments on our engineering staff.

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COUNCIL

(Continued from page 11.)

In my own opinion it is well that we take time to dwell on matters of personal industry, merit and conduct. Engineers of today enjoy opportunities that are rarely experienced by similar groups. There is public recognition of the important part the engineer has in modern society, and a high demand for his services. If we accept these good fortunes graciously and employ our opportunities wisely so as to earn public trust and confidence, we shall attain and be able to hold a responsible and respected place in our society. On the other hand if we act with arrogance and pervert the excellent conditions that exist, to promote selfish interests, in all probability, our good fortunes and successes will be short-lived. In seeking legislation to promote the interests of the engineer, it is well to keep in mind that the system of laws was designed to serve the citizen and the community in general and not to serve the special interests of any particular group. Many of the old guild movements fell into public disfavor because in the eyes of the public they employed laws and regulations to promote their own interests at the expense of the community interests, and the community members took counter-measures against the guilds. Possibly these acts explain the rise and fall in the prestige of past guilds. Whatever we do, our actions will be observed and judged by members of our society and it is to our benefit that our conduct and endeavor be such as to win favorable acclaim. At this point in our training may I advocate, that as a means of promoting our general welfare we lean lightly on legislation and learn to lean heavily on individual industry and merit, and personal worthiness.

To the students joining us for the first time, may I encourage you to make up your mind at the outset to apply yourself to your studies with diligence and considerably more industry than you possibly applied in High School. You will find, as those of us who are here have found, that the college curricula demands much more of your time and industry than do the high school curricula. The engineering curricula are difficult and time consuming and the rate of attrition among engineering students is high. For example, at the present rate of attrition, approximately 20% of the freshmen students entering the School of Engineering this fall will complete the prescribed courses and obtain a bachelor's degree in engineering. I do not cite these figures to discourage you, but only to illustrate that unless your basic interests are in engineering, and you are prepared to work hard, the probability of obtaining a degree in engineering is 5 to 1 against you.

Getting off to a good start the first year is an important accomplishment in the task you have outlined for yourself. As your time and studies permit, you are encouraged to participate in the extra-curricular activities conducted under the auspices of the School of Engineering. The handbook, "Engineers' Guide," contains an outline of the student organizations on campus and a schedule of activities being sponsored this year so I will not repeat them here. I would like to remind all students that the *Engineers' Mixer* will be held on October 12th at 8:00 P.M. in Lisner Lounge. Plan to attend. Admission is free; entertainment will be provided and refreshments will be served.

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AFGHANISTAN

(Continued from page 15.)

flow pattern and the configuration of the crest and channel were altered to produce good streamlining. This test resulted in a new design which reduced the spillway rock excavation by 122,000 cubic meters from the estimated 347,000 cubic meters of rock excavation in the original design.

The Arghandab Dam is the key to the whole project development of the valley. The design period of the dam has been estimated to be about 87 years. This design period is based on the silt deposits of the river. The engineers of Morrison-Knudsen Afghanistan, Inc., have reached this estimate assuming that the silt-depositing rate of the Arghandab River is the same as that of the Colorado River. However, they also point out that the Colorado River is particularly bad in this respect. They say that if the silt-depositing rate of the Arghandab were assumed to be one-fourth as much, the reservoir would be silted up in about 343 years.

CANALS AND DITCHES

Existing canals and ditches command about 120,000 acres but because of the uncertain water supply, only 100,000 acres are cultivated. Since 120,000 acres are to be irrigated from the reservoir alone, some new canals are needed and the old ones are to be improved. These works are currently in process.

SUMMARY

The prosperity of Afghanistan is fundamentally dependent on agriculture and, since irrigation water is practically the only water available, the significance of irrigational projects can never be over-estimated. It is through irrigational schemes that the rivers of the country are intelligently harnessed to irrigate its fertile lands, and thus make enough new lands available for the population, especially for nomads and ambitious farmers who have a limited amount of land at present.

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3 activities does YOUR
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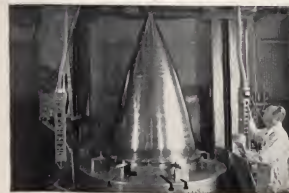
RESEARCH AND DEVELOPMENT.

Projects of the engineers and scientists in this area at Hughes encompass practically every known field of electronics—and often border on the unknown. It is this team which is responsible for the Falcon air-to-air guided missile and the Automatic Armament Control System. Some of the projects include Microwave Tubes and Antennas, Digital and Analog Computers, Ground and Airborne Radar systems, long-range highly miniaturized communications equipment, and missile systems.



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Slipstick Slapstick

Dean: "Didn't you read the letter I sent you?"

M.E.: "Yes, Sir. I read it inside and outside. On the inside it said, 'You are requested to leave college,' and on the outside it said, 'Return in five days,' so here I am."

Wife: "Dear, tell me, how did you ever get Junior to eat olives?"

M.E.: "Simple, I started him on martinis."

"Your girl is spoiled, isn't she?"

"Naw, that's just the perfume she uses."

"Professor," said the engineer in search of knowledge, "will you try to explain to me the theory of limits?"

"Well, John, assume that you have called on a pretty woman. You are seated at one end of the divan and she is seated at the other. You move halfway toward her. Then you move half of the remaining distance toward her. Again you reduce the distance separating you from her by 50 percent. Continue this for some time. Theoretically, you will never reach the girl. On the other hand, you will soon get close enough to her for practical purposes."

Tony: "Give me a cigarette, Dave."

Howard D.: "I thought you had quit smoking."

Tony: "Well, I got to the first stage, I quit buying."

"Do you know who was the first engineer?"

"No, who?"

"Adam, he furnished spare parts for the first loud speaker."

A new AFROTC officer stopped the young man in the neatly fitting uniform entering the Davis-Hodgkins House and asked:

"What's the eighth general order?"

"I don't know," the fellow admitted.

"Have you ever been out to drill?"

"Nope."

"Don't you know enough to say sir, either? What outfit you in?"

"Me? I'm the Pepsi-Cola man."

"Do you have any physical defects?" the army doctor asked.

"Yes, Sir!" the draftee answered promptly. "No guts."

When two people are under the influence of the most violent, most insane, most delusive and most transient of passions, they are required to swear that they will remain in that excited, abnormal and exhausting condition continuously until death do them part.

—G. B. Shaw

A lad applied for a job at a drug-store. His interviewer began to fill in the form.

"Your name?"

"Henry Ford," answered the boy.

"That's a pretty well-known name, isn't it?"

"It ought to be," said the boy. "I've been delivering groceries in this neighborhood for two years."

A beautiful girl was walking along the sidewalk one evening on her way to the movie. She noticed a small bird laying at the side of the walk with a broken wing. Instead of going to the movie she took the bird home, bandaged its wing, and fed it. In a few weeks the bird was well enough to fly away.

Now let's see you guys find anything dirty in that.

A woman with child was told by her doctor that until her child was born she must stop chain-smoking or suffer the serious consequences. The lady failed to heed his advice. The months passed, and at last her baby was born. Sure enough, there at the end of the baby's spine was a little butt.

For years the bunn slept under bridges and in ditches. Then one day he switched to culverts and became a man of distinction.

The C.E. had just finished a quiz and had purchased a bottle of Scotch. On his way home he was knocked down by an automobile. Picking himself up he felt something trickling down his sleeve.

"Oh, Lord," he groaned, "I hope that's blood."

Coed: "Do you want to go steady?"

E.E.: "Oh, yes."

Coed: "Try Castor Oil."

People are like steamboats — they toot loudest when they are in a fog.

THE MECHELECTIC

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